Jovian H3+ auroral dynamics and Io volcanic activity obtained with IRTF and Haleakala telescopes

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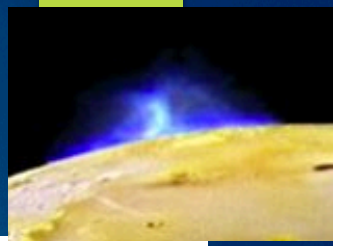
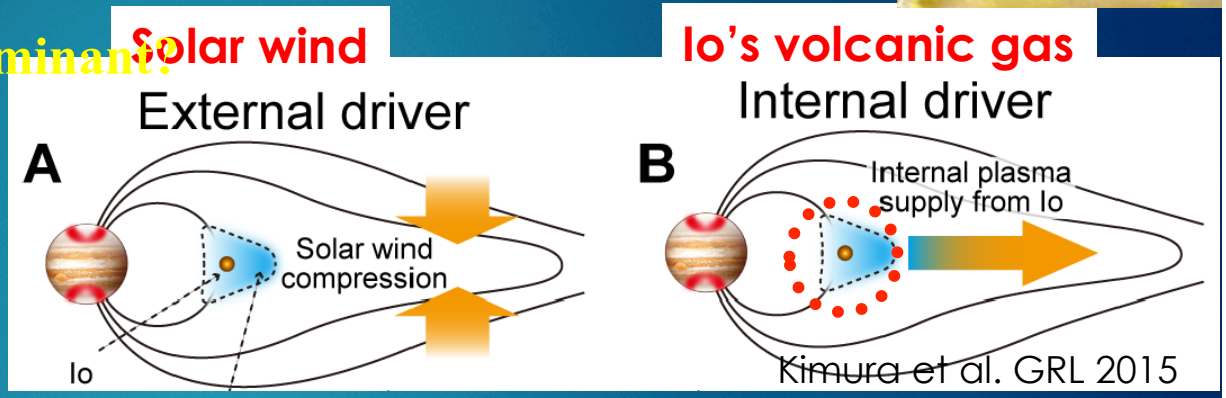
Jovian aurora

- Aurora is a good indicator of complicated coupling processes between solar wind, Jovian magnetosphere and atmosphere.

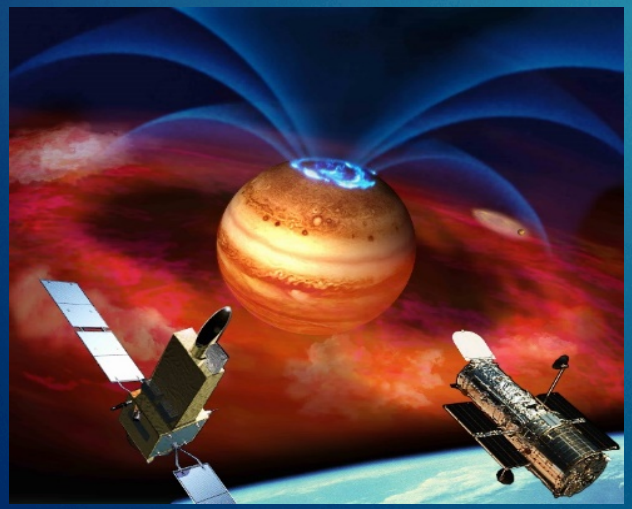


Which process is dominant?



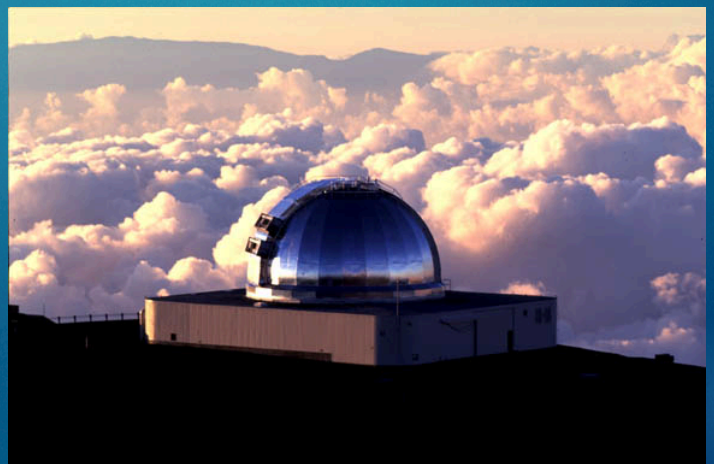
Campaign for Jupiter in 2016

Hisaki/EXCEED and HST (UV aurora)

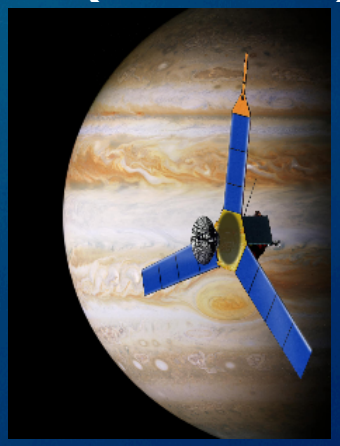


JAXA, ACU, Lancaster U press

IRTF(IR aurora)



Juno(solar wind)



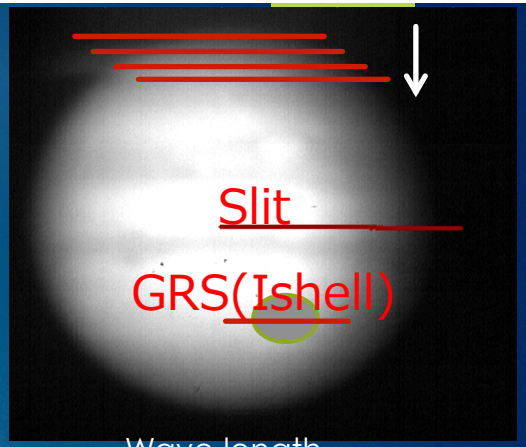
NASA IRTF

CSHELL: 2008, 2009, 2010, 2011, 2014, 2015, 2016

ISHELL: 2017

2 Ph.Ds

Uno et al., Planet. People, 2012
Kita et al., JGR, 2015
Uno et al., JGR, 2015
Kita et al., in revision.
Sakanoi et al., in prep.

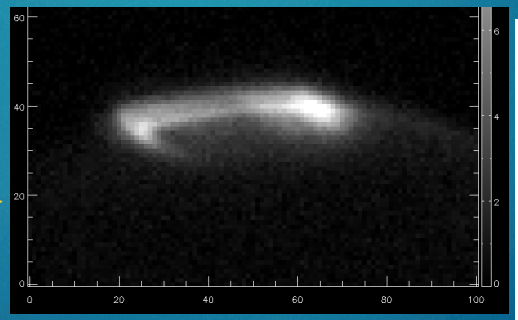


CSHELL →

SP: High resolution single order spectrograph

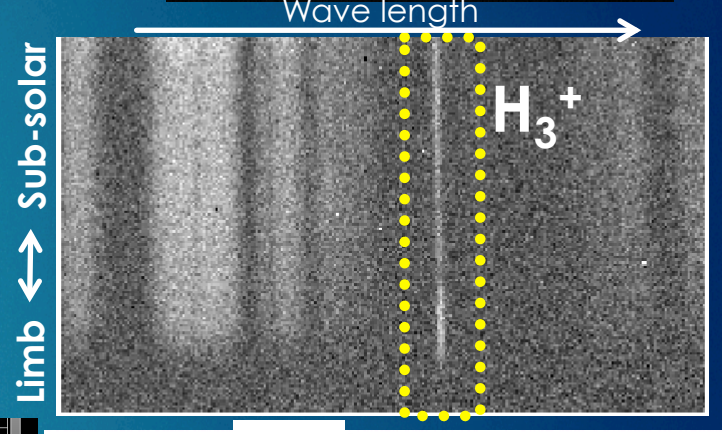
- Slit width: 0.5 arcsec
- Resolution: λ/Δλ=43000
- H_3^+ Q(1,0-) 3.953μm

IM: CVF filter →

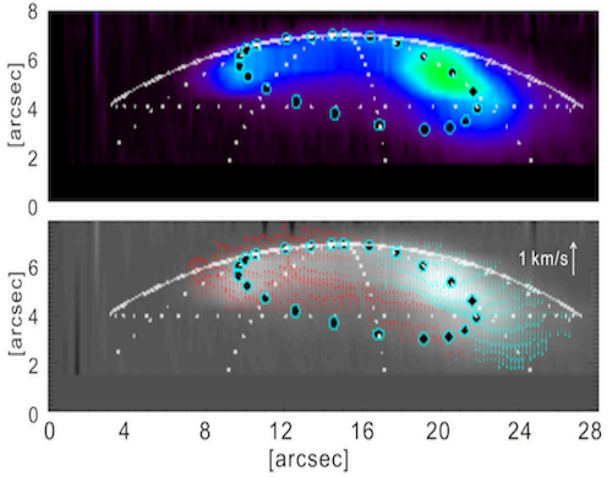


- Wavelength: 3.43μm
- H_3^+ R(3,0), R(3,1), R(3,2), R(3,3)

- CML 130~210



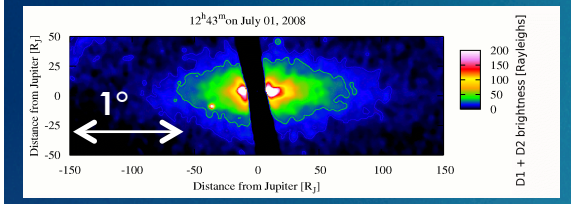
2009 Sep6, 7:49UT
CML=190



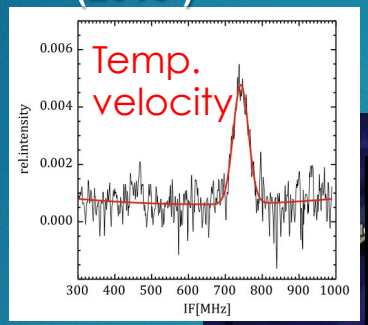
Tohoku telescopes at Haleakala, Maui

- **Continuous monitoring of planets**
- **Flexible and timely coordination with other instrument**
- **Unique instruments**

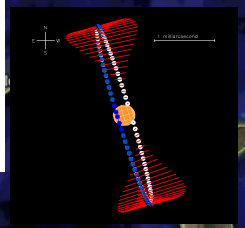
Wide-FOV imager, Io sodium nebula (1998-)

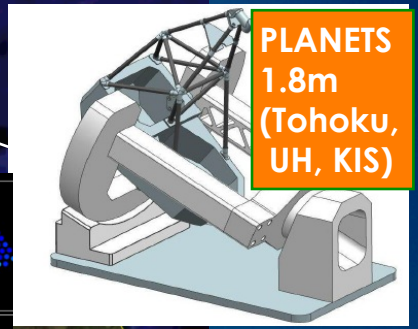


MILAHI: Mid-infrared heterodyne spectr, Venus and Mars CO2 non-LTE emission (2015-)

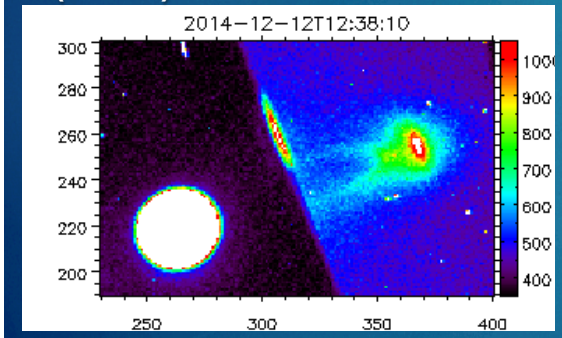


DIPOL-2: Exoplanetary polarization (2014-) [KIS, U.Turku]

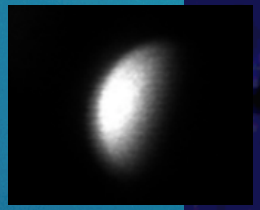


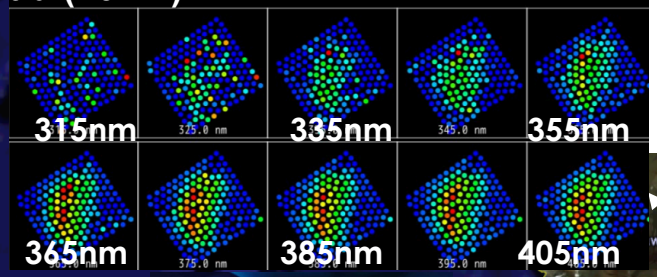


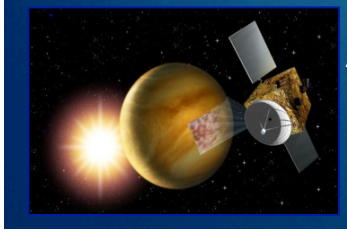
Vispec: Visible echelle, Io plasma (S+) torus (2006-)



Fiber-array spectr. Venus UV cloud (2017-)

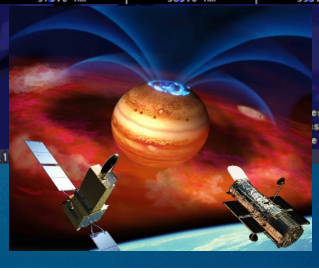






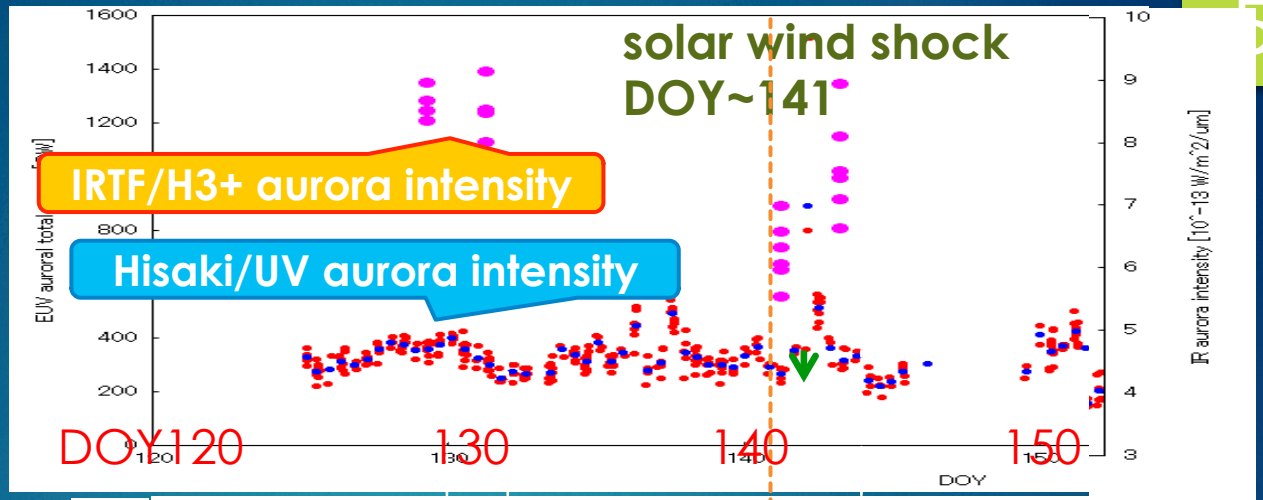
Akatsuki (Venus)

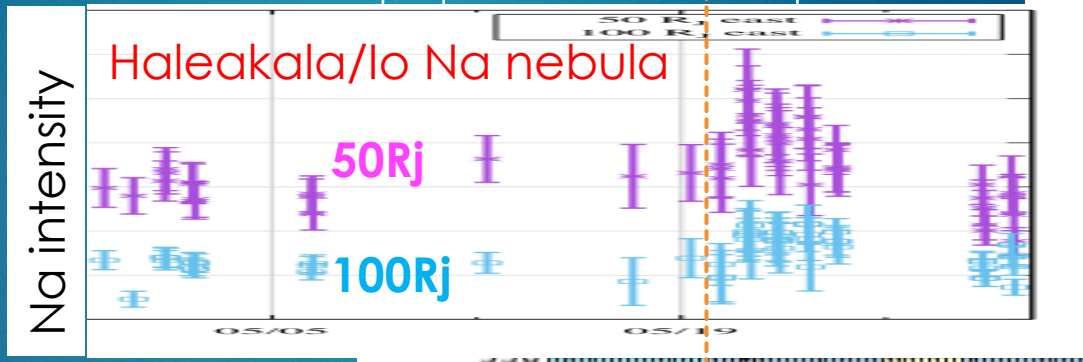
MEX MAVEN ExoMars (Mars)



Hisaki HST Juno (Jupiter)

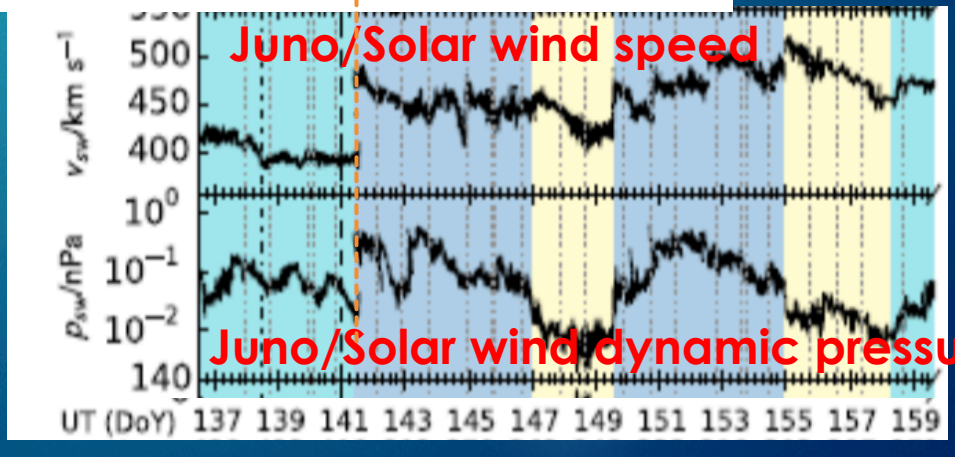
Time variation of H_3^+ and UV auroras





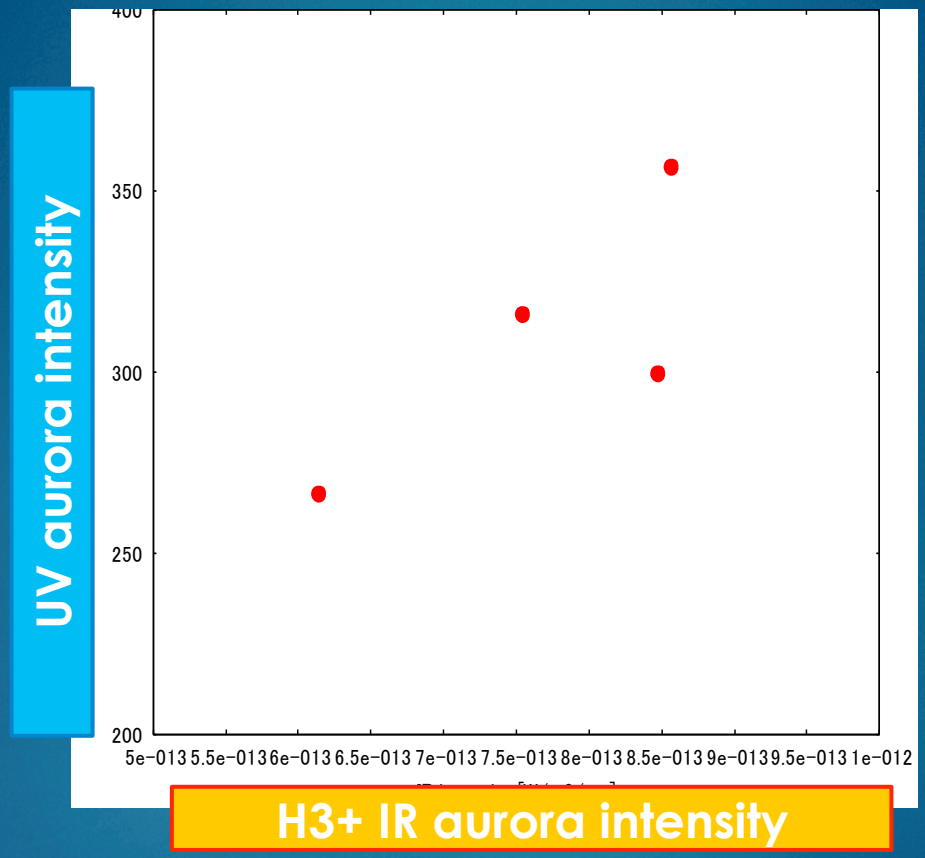
[Nicolas et al., 2017]

- DOY~141: solar wind shock
- DOY~142: Io volcanic activity
- DOY~142-143: UV and IR aurora enhancement



Relationship between H_3^+ and UV aurora

Averaged for one night
in the CML range of 130-210



- **H3+ intensity roughly corresponded to the UV auroral total power**
  - **Electron precipitation ⇔ H3+ density**

Summary

- IR and UV auroras increased with the arrival of solar wind shock on DOY ~ 141 in 2016.
- Almost simultanelusly, Io volcanic event happened.
- Thermospheric wind velocity seems to increase as auroral intensity increases.

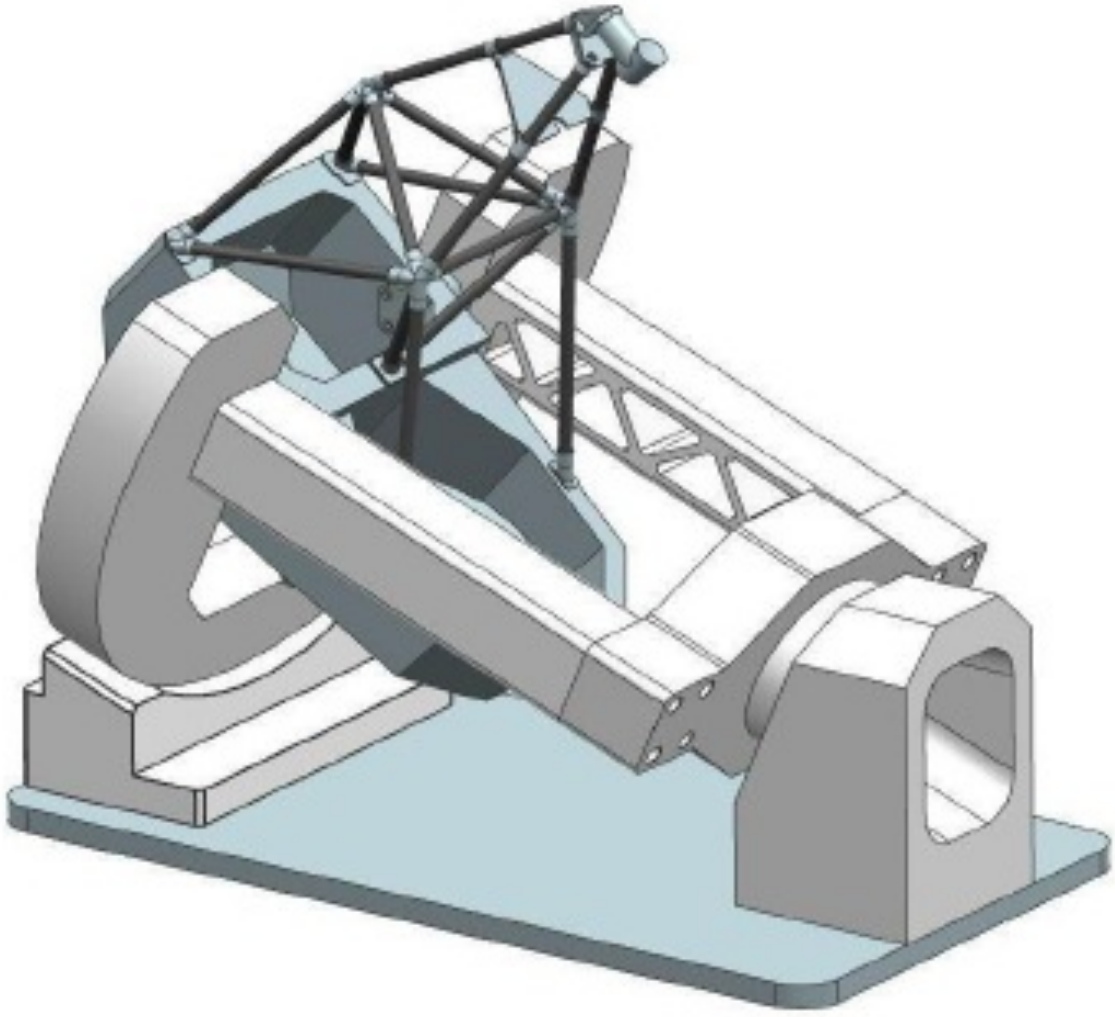
How to distinguish the io volcanic effect on aurora from the solar wind control?

PLANETS
JapanHawaiiEuropeTelescope

PLANETS 1.8-m off-axis telescope

https://www.planets.life/

- ✓ Mid-size low-scattering light telescope
- ✓ Continuous monitoring observation of planetary and exoplanetary targets



The PLANETS telescope project is promoted and will be operated by the PLANETS foundation consists of Tohoku Univ., IfA/UH, KIS, Brazil, France etc.

Thank you!